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East Europe Report

SCIENTIFIC AFFAIRS

No. 713

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CONTENTS

RYAD-32 COMPUTER HARDWARE, SOFTWARE CONFIGURATIONS DESCRIBED

Warsaw WIADOMOSCI TELEKOMUNIKACYJNE in Polish No 4, Apr 81 pp 110-116

[Article by Eng Waclaw Piwonski: "The EC-2032 (R-32) Electronic Digital Computer"]

[Text] This article is about the most popular uniform system [JS] computer in Poland today: the EC-2032 (R-32). It is manufactured at the MERA-ELWRO plants in Wroclaw within the framework of Poland's specialization among the CEMA countries. A typical configuration for this computer is shown in Figure 1. It consists of a central processing unit [CPU] having an operating memory of 512 kilobytes [kB] (1,024 kB maximum), an eight-unit disc memory with a 30 megabyte [MB] capacity, a six-unit PT-3 tape memory (the disc and tape memories are connected to the processor by means of a control unit), two EC-7033 high-speed printers, two EC-6016 card readers, and a operator's console (this can be a EC-7076 character-mosaic printer or a EC-7910 CRT display unit).

In addition to strictly technical data, this article presents certain information concerning the structure of the operating system which will be useful in evaluating computer capabilities.

The EC-2032 digital computer (popularly known as the RYAD-32 or R-32) is one of the basic JS computers. It is considered to be either a medium-class or large-class computer depending on memory capacity and configuration of peripheral equipment. It is designed to solve extensive and complex problems in the areas of electronic data processing and scientific-engineering calculations. The EC-2032 CPU consists of three basic components: a processor, channels and an operating memory. The processor controls the processing process in accordance with a given program. The processor is connected to peripheral equipment via input-output [I/O] channels, namely multiplexer channels and selector channels. A multiplexer channel permits a number of I/O devices to be connected, most frequently slow- and medium-speed data-transmission equipment such a perforated-card equipment, printers and the like. A multiplexer channel contains 256 individual subchannels or 120 undivided and 8 divided subchannels. Only one I/O device can be connected to an undivided subchannel, but up to 16 I/O devices can be connected to a divided subchannel. In the multiplexer mode, data-transmission speed is 145 kB/s; in the selector mode it is 470 kB/s. A selector channel permits high-speed peripheral devices (external disc and tape memories and the like) to be connected to the processor. Up to 8 control units can be connected to a single selector channel, which in turn can control up to 256 I/O devices. The total capacity of the

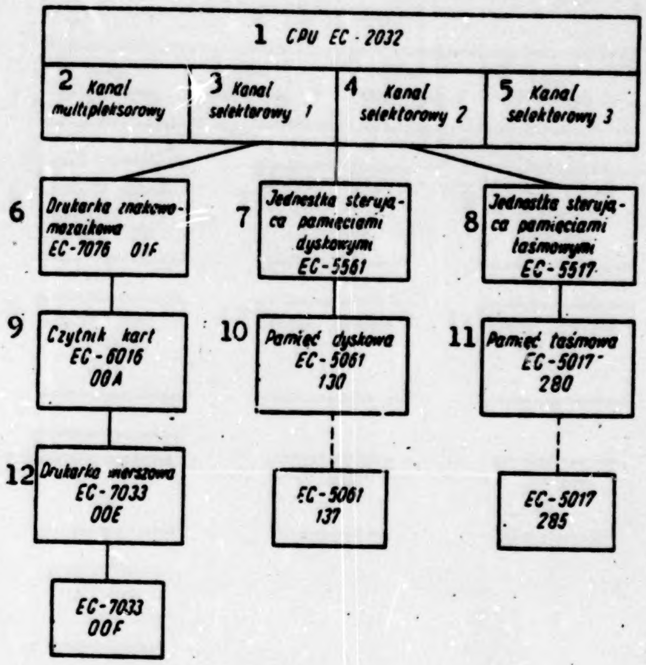

Figure 1. A typical EC-2032 (R-32) configuration

Key:

1. EC-2032 central processing unit
2. Multiplexer channel
3. Selector channel 1
4. Selector channel 2
5. Selector channel 3
6. EC-7076 01F character-mosaic printer
7. EC-5561 memory disc control unit
8. EC-5517 memory tape control unit
9. EC-6016 00A card reader
10. EC-5061 130 disc memory
11. EC-5017 280 tape memory
12. EC-7033 00E line printer

selector channels is 2.5 MB/s. The operating memory stores instructions as well as processed data. It consists of 4,096-byte (4 kB) memory modules. Memory capacity can be 128 kB to 1,024 kB, based on individual memory modules having 128 kB capacities. A byte (8 bits + 1 control bit) is the smallest unit of information that can be addressed in the operating memory. Bytes within a memory module can be addressed directly. Memory locations are addressed by a 24-bit number starting with 0.

Technical Data

The EC-2032 CPU

Length of computer word--32 bits;
Computer basic cycle--300 nanoseconds [ns];
Control--microprogram;

Execution times for basic arithmetic operation--2.4 to 16.4 ns;
Average speed (according to the Gibson 1 mix)--220,000 operations per second;
Number of control units--up to 8;
Data transmission speeds:
Multiplexer moder--145 kB per second,
Selector mode--470 kB per second;
Memory for control words--4 kB (portion of operating memory programically inaccessible);
Selector channels:
Number--3,
Number of subchannels in each channel--256,
Number of control units per channel--up to 8;
Operating memory:
Capacity--128 to 1,024 kB,
Each additional memory module--128 kB,
Cycle (for one word)--1.2 microseconds [us],
Access time--0.5 us,
Word length--36 bits including 4 control bits,
Memory protection--while recording as well as while recording and reading;
Input power--380/220 VAC, +10 percent, -15 percent; 50 Hz, ±2 percent;
Power consumption:
With a 256 kB CPU--3.8 kilovolt amperes [kVA],
With an additional 256 kB--2.0 kVA;
Permissable operating temperature--5°C to 40°C;
Recommended operating temperature--20°C to 24°C;
Permissable humidity--40 percent to 60 percent;
Weight:
256 kB CPU--430 kg,
Additional 256 kB module--250 kg.

The EC-7033 Line Printer

The EC 7033 line printer is a device designed to retrieve quickly information from JS computers in the form of texts or tables. It is a buffered-drum printer based on transistor-transistor logic [TTL] integrated circuits.

The printer operates with the CPU in accordance with the principles defined by the JS interface standard. The printer stores data transmitted from the CPU via a multiplexer channel in a one-line-capacity memory. After the memory is filled up, its contents are printed; this in turn permits the next portion of information to be received.

The printing of characters is based on "in-flight" printing; electronically excited hammers strike through paper and dyed tape the printer drum spinning at a constant speed. Printing speed can change, depending on the printer's mode of operation. If single spacing between lines is maintained, the printing speeds are:

100 lines/min for fast operation--1100,
50 lines/min for slow operation--550.

One or more printers can operate in a JS digital computer configuration.

The EC-5017 Tape Memory Unit

A tape memory is used to store information in the form of data or programs. The amount of information that can be stored is practically unlimited, depending only on the amount of magnetic tape possessed. The use of a one-roll tape-drive system from the base side assures long tape life or capacity to be used repeatedly for information record and readout operations. From the magnetic carrier side, the tape touches the heads only during information record and readout times, but it does not touch during rapid rewind. The magnetic-heads assembly consists of nine double-gap read-write heads and an erasing head. The entire equipment mechanism is mounted on a rotatable frame, permitting easy access to and replacement of specific assemblies.

Tape speed:
    Record and readout--3 ms,
    Rewind--5 ms;
Record density--8, 16, 32 bits/mm;
Record type--NRZ 1;
Number of tracks--9;
Interblock gap--15.2 mm;
Maximum transmission rate--128,000 characters per second;
Magnetic head--universal record and read-out in accordance with ISO [International Organization for Standardization] standards;
Tape parameters:
    Maximum length--750 m,
    Width--12.7 mm;
Spool outer diameter--267 mm;
Power consumption--1.0 kVA;
Weight--359 kg.

The EC-5061 Disc Memory Unit

Disc memory units are the primary means of storing so-called mass information. Up to eight units can be connected to one EC-5561 control unit.

The capacity of a single replaceable disc packet is 30 MB. Each packet contains 20 working surfaces and 20 heads. Each disc surface contains 200 tracks plus three reserve tracks. The disc revolves at 2,400 rev/m $\pm$ 2 percent. Average access time is 60 ms.

The EC-6016 Card Reader

Information carrier--80- or 90-column card;
Maximum read-in speed--60,000 cards per minute;
Card code--KPK or binary;
Magazine capacity:
    Card feed--2,000 cards,
    Card stacker--2,400 cards;
Photoelectric read;
Mechanical blade feed, start-stop operation.

The EC-7076 Charac.er-Mosaic Printer

Printing rate--up to 180 characters per second;
Type of print--mosaic (7X7 matrix);
Number of characters--up to 96;
Line width--132 characters;
Keyboard character set:
- Letters of the Latin and Cyrillic alphabets,
- Digits,
- Punctuation and control characters;

Power consumption--250 VA;
Recommended temperature of environment--20°C to 24°C;
Weight--25 kg.

The character-mosaic printer is used as an operator's console in the EC-2032 system.

The EC-7910 Cathode Ray Tube [CRT] Monitor

Rate of transmission--up to 2,400 bits per second;
Maximum monitor capacity--1,920 characters (24 lines X 80 characters per line);
Keyboard--alphanumeric and digital.

System Software

The operating system is one of the primary elements of a modern computer system. Its output and proper operation determine a system's efficiency as much as the quality and technical parameters of its hardware. Therefore it is not surprising that as more complex computer systems are placed into operation, interest increases in their theoretical and practical efficiencies as well as in methods of measuring them.

A operating system is a set of programs (operating under the supervision of a central program) which controls the input of data into operating memory, the operation of I/O devices, the translation of programs, the assignment of memory and the management of data. It also controls the proper operation of the computer and accounts for the system's operation. The extent of the operating system is attested to by the fact that it would require 6 million cards to record it on perforated cards.

When operating an IBM or JS computer, two types of operating systems are used: the Disc Operating System [DOS] and the Operating System [OS]. This article in particular describes the OS, the most universal and popular system. Its advantages are:

--It is easily adaptable to a hardware configuration;
--it is capable of organizing various ways of processing;
--it is equipped with extensive auxiliary software and efficient translators for the most popular programming languages.

The SMF [System Management Facility] is an OS option that is added to the OS at the system-generation stage. The SMF consists of a set of programs whose purpose is to collect and store information on system activity concerning:

--session start and finish;
--allocation of and access to files on external carriers;
--the parameters of the executed job (start and finish times, number of consignments, amount of memory employed, and the like);
--TSO session start and finish;
--statistics on errors occurring on magnetic carriers.

This information is recorded on discs on the SYS1. MANY and SYS MANY system files in the form of defined types of records. To have a permanent record, they must be successively recorded in a file containing a complete set of records for a certain time period (in practice, on magnetic tape). Information collected this way can serve to present a system's operating data for a given time period. After the currently obligatory price list is fed into the system, the SMF system uses information it has gathered to print prepared invoices for individual clients that include the cost of all services performed during the last month or quarter.

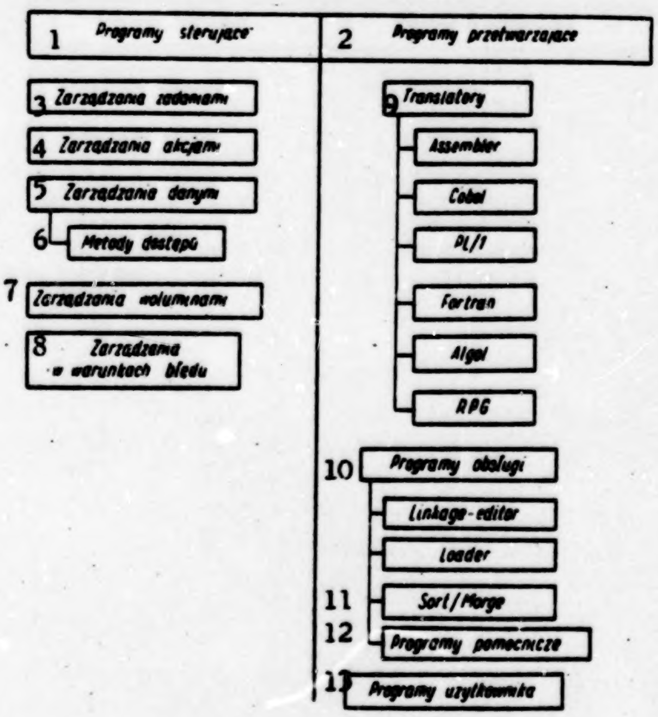

Figure 2. The OS/JS operating system

Key:

1. Control programs
2. Processing programs
3. Task management
4. Operation management
5. Data management
6. Access methods
7. Volume management
8. Recovery management
9. Translators
10. Service programs
11. SORT-MERGE
12. Auxiliary programs
13. Utility programs

The OS consists of two groups of programs: control programs and processing programs (see Figure 2). A control program can operate with a fixed number of tasks (multiprogramming with a fixed number of tasks [MFT]) or with a variable number of tasks (multiprogramming with a variable number of tasks [MVT]). Independently, one can opt for the so-called division operation (TSO) or remote-access operation (RJE, CRJE).

The MVT version of the OS/JS operating system permits one or several streams of input jobs to be processed. Up to 15 jobs can be processed at one time. Each one of the jobs can initiate tasks which are executed simultaneously with tasks created by the system and the operator. The number of simultaneously executed tasks on the MVT system is limited only by the amount of currently available resources. In addition to an area reserved for control programs, the operating memory contains an additional area (LPA--link pack area) for resident modules where the access method modules are located. The remaining area of memory is the so-called memory pool. Control programs assign subpool (called a region) from this pool for each initiated step. After the step is completed, the area of the region is returned to the pool.

Control Programs

Control programs consist of the following programs:

--job management;
--task management;
--data management;
--volume management;
--recovery management.

Job Management

In the OS system, a job is a specific problem that is solved using one or many programs. Job-management programs control and supervise the stream of jobs through the system, assuring the most efficient use of the system's resources. The basic tasks of these programs are to:

--introduce and analyze the stream of inputs: read and interpret the control sentences, create a structure representing the job;

--manage and supervise system resources: allocate I/O equipment, manage peripheral memories, check the possibility of access to volumes needed for processing;

--schedule operations: decide the starting order in which specific jobs will be executed by the system according to a specified principle (priorities or the first-in-first-out principle);

--permit communications between the operator and the system.

A user defines his requirements regarding the program and data files necessary to process his job via the sentences of the job control language.

The basic tasks of this language are:

--the JOB task designates the job beginning, contains information concerning the job (class of input, instruction number, required operating memory, maximum processing time, priority and the like);

--the EXEC task designates the initial step of the job, specifies the program or procedure designated for execution, and supplies supplementary information (for example, execution time, conditions for disregarding a step, parameters and the like);

--the DATA DEFINITION [DD] task serves to record data files, identify files, specify equipment and volumes containing files, list file attributes, and list much other information permitting the use of various options offered by the system.

Activities associated with introducing the input stream, outputting data and scheduling the execution of jobs are executed by a group of programs known as the Job Scheduler.

The Reader/Interpreter program reads into the system the job definition provided by the user using job-control-language sentences, verifies the formal correctness of these sentences, creates appropriate control tables and then locates a job in the appropriate input queue in accordance with the parameters defining the input class of the JOB task.

Activities associated with the start and finish of jobs and their steps are executed by the Initiator/Terminator program. The primary tasks of this program are to select a job from the proper input queue, to allocate and release required resources, and to control the installation and removal of volumes.

During the course of processing jobs, input files which are usually assigned to slow devices such as a line punch, card perforator and so on, are temporarily recorded on external fast memory devices such as discs or drums, and after the jobs are finished they are placed on the output queues.

A specialized output service program--the System Output Writer--selects files from the output queues and records them on appropriate devices.

Thanks to the processing method used, during which the inputting of jobs, their execution and the outputting of their results are independent of one another and can be executed simultaneously, a significant increase in system productivity is achieved, that is, the number of jobs executed in a given time increases. The use of specific system components such as line printers, card readers and perforators and the like, also increases greatly.

Programs that are part of the job management programs group and are included in the so-called Master Scheduler attend to messages issued by the system and communications between the operator and the system.

The MVT control program permits the simultaneous execution of up to 15 jobs. The jobs are initiated by the Initiator/Terminator program in accordance with

parameters specified by the operator. Each job is treated as a separate task and competes with other jobs for the system's resources based on execution priority.

Task Management

In the OS this task is the basic unit of the executed work. All jobs to be processed must be presented in the form of a series of tasks. After initiation, these tasks compete for the system's resources (such as the CPU, operating memory and so on, and the Task Management programs supervise and control demand for the resources. The primary functions of the Task Management programs are:

—service: analyze reasons for interruptions in order to specify appropriate supervisor action;

—task supervision and control: record the tasks in the system, their status and priorities and designate the order of their execution;

--operating memory management: record unoccupied and allocated memory areas and the assignment and release of memory areas;

—supervising operating memory contents, loading programs into memory, keeping records of loaded programs as well as their attributes;

—clock service: set and operate the clock according to the needs of programmers.

The creation of tasks is done by processing EXEC statements or executing ATTACH macroinstructions. At that moment, control modules are created which specify the task during the entire time of its execution. When the task is completed, control is transferred to the control program which removes the control modules from the system and releases allocated resources and data files.

To control a task effectively, the system offers the programmer a number of conveniences such as dynamic changes of task priorities, apportioning time among a designated group of tasks and the possibility of task resumption in case of an abnormal finish.

Data Management

With the OS a user can simply manipulate, in various and extensive ways, data files by using a group of specialized data-management programs.

These programs are responsible for transferring data between the peripheral devices and operating memory, for analyzing the correctness of this transmission, and also for many auxiliary operations.

A user creating a data file can select a file organization that is most appropriate for his application. The OS assists the files with regard to sequential, direct, index-sequential and zone organization.

When processing a data file, one of two file access techniques can be used. Using the queueing technique, the user is concerned only with the file's logical records.

Data-management programs either record a subsequent record or make it accessible in response to the use by the program of an appropriate macroinstruction. The user is relieved of many jobs associated with the organization of I/O operations such as buffer management, blocking and unblocking records for synchronizing I/O operations.

The use of the basic access technique permits a user to operate on the physical records (blocks). Then the user is obligated to verify the correctness of I/O operation completions, the synchronization of these operations, and the blocking and unblocking of records. Greater processing efficiency and flexibility can be achieved at the cost of greater programmer effort.

One of the most important advantages of using data-management programs is that it becomes possible to make the written programs independent of I/O devices. This can be achieved because the program communicates with data-transmission service programs via standard I/O macroinstructions. The use of a different I/O device simply causes the use of other data-management modules without having to make changes in the program itself.

In addition to the above basic tasks, data-management programs offer a programmer the possibility of making use of many other conveniences of which the most important are:

--the use of standard, nonstandard and user label files;

--the possibility of locating a file through the use of the system's catalog;

--the possibility of defining operating groups of data files;

--protecting files against destruction or uncontrolled access;

--the use of special stipulations such as end of file, end of volume, depletion of file space, I/O error and the like.

The realization of I/O operations is executed by access-method procedures and the I/O supervisor.

The procedures of the method of access to data files control the exchange of information between operating memory and I/O devices and assure proper organization of data files.

Method of access means combining the access technique with file organization.

There are four methods of access associated with file organization:

PS--sequential;
PO--library;
DA--direct;
IS--index-sequential.

Table 1.

1 Techn. dostępu	2 Org. zbioru			
	PS	PO	DA	IS
3 Kolejkowa	QSAM	—	—	QISAM
4 Podstawowa	BSAM	BPAM	BDAM	BISAM

Key:

1. Access technique
2. File organization
3. Queued
4. Basic

Volume Management

The possibility exists in the system of defining the status of a carrier; it is the statistical possibility of using a volume. There are two types of statistics: statistics of volume errors and analysis of volume errors.

Recovery Management

The operating efficiency of a computer system can decrease significantly if some of its components are not performing properly. To limit disturbances in the operation of the system resulting from such situations, the OS contains a group of programs which permit the repetition of operations after an error occurs, the recording of the conditions under which the disturbance occurred, and they also conduct an analysis and attempt to eliminate the error or to bypass it.

System Environment Recording [SER] programs record in the SYS1 system files-control unit and channel errors. The Machine Check Handler [LOGREC MCH] analyzes the conditions under which the errors occurred and attempts to resume the erroneously completed operations.

The Channel Check Handler [CCH] programs analyze channel errors and set up conditions to permit the repetition of unsuccessful operations.

The Alternate Path Reentry [APR] program permits the execution of repeat operations via another connection through the channel.

The Dynamic Device Reconfiguration [DDR] program executes volume transfer for which an I/O operation has been terminated because of the failure of other physical devices and renew attempts to execute the operation.

It also is possible to test I/O equipment, channels and control units for proper operation with the aid of the On-Line Test Executive Program [OLTEP], a collection of generating programs.

Processing Programs

Processing programs include translators and service programs.

Programming Language Translators in the OS/JS System

Translators transform source modules into object modules. While translating a source program, a translator checks for correct syntax and reports errors, their location in the program and the reason fcr the errors. Figure 3 shows a diagram for processing a source module.

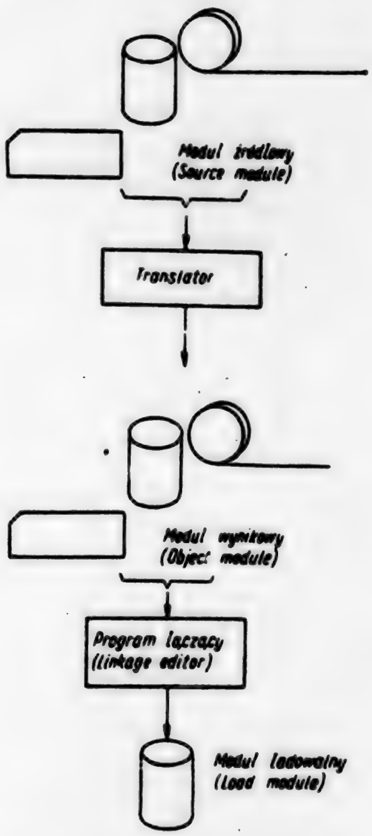

Figure 3. Processing a source module in the OS/JS system

The ASSEMBLER

Catalog procedures:

ASMFC--compilation;
ASMFCL--compilation and linkage;
ASMFCG--compilation and execution;
ASMFCLG--compilation, linkage and execution.

COBOL

The complete COBOL ANS/COBOL language (American National Standard) version is used.

Catalog procedures:

COBUC--compilation;
COBUCL--compilation and linkage;
COBUCG--compilation and execution;
COBUCLG--compilation, linkage and execution;
COBULG--linkage and execution.

PL/1

Catalog procedures:

PL1DEC--compilation with output on cards;
PL1LFC--compilation;
PL1LFCL--compilation and linkage;
PL1LFCG--compilation and execution;
PL1LFCLG--compilation, linkage and execution;
PL1LFG--execution;
PL1LFLG--linkage and execution.

FORTRAN

Two FORTRAN 1V language translators are used (levels G and H). These translators differ with regard to the amount of memory used and the speed at which source programs are translated.

FORTRAN G

Catalog procedures:

FORTGC--compilation;
FORTGCL--compilation and linkage;
FORTGCLD--compilation and execution;
FORTGCLG--compilation, linkage and execution;
FORTGLG--linkage and execution.

FORTRAN H

Catalog procedures:

FORTHC--compilation;
FORTHCL--compilation and linkage;
FORTHCLD--compilation and execution;
FORTHCLG--compilation, linkage and execution;
FORTHLG--linkage and execution.

ALGOL

The ALGOL translator realizes practically the complete ALGOL 60 standard version.

Catalog procedures:

ALGOFC--compilation;
ALGOFCL--compilation and linkage;
ALGOFCG--compilation and execution;
ALGOFCLG--compilation, linkage and execution.

RPG

Catalog procedures:

RPGEC--compilation;
RPGECLG--compilation, linkage and execution;
RPGELG--linkage and execution.

Service Programs

Service programs include:

--the linkage editor and a loader which prepare programs for execution in a system;

--the data file sort-merge program;

--auxiliary programs that perform many organizational functions and operations to transfer files from one carrier to another.

The Linkage Editor

This program links object modules created by a programming-language translator into a single program (a load module ready for execution).

Catalog procedures:

LKED--linkage;
LKEDG--linkage and execution.

The Loader

The loader links loader functions and procedures transferring a load module into operating memory. There are no catalog procedures for the loader.

SORT-MERGE

This program can execute sorting operations or link data files recorded on any I/O device which can operate from QSAM. Sorting can occur in accordance with 1 to 64 sorting keys. Linkage can be executed for 2 to 16 previously sorted files.

Catalog procedures:

SORT--with the possibility of linking the EXIT routine in the form of a object module or load module;

SORT--with the possibility of linking the EXIT routine in the form of a load module.

System Files

System files can be divided into two groups: files that include subprograms associated with translators and files associated with the realization of a specific OS function.

The first group includes:

SYS1. ALGLIB
SYS1. FORTLIB
SYS1. PL1LIB
SYS1. COBLIB

The second group includes:

SYSCTLG--this file includes information on all of the system's catalogued data files;

SYS1. SVCLIB--this file includes nonresident SVC procedures, access method procedures and standard system procedures for error operations;

SYS1. SYSJOBQE--this file is used as a working area by the tasks stream coordinator;

SYS1. LINKLIB--this file includes nonresident programs of the OS such as the ASSEMBLER and COBOL compilers, the linkage editor and some IEBCOPY, IEHLIST and IEBUPDTE auxiliary programs;

SYS1. PROCLIB--this file contains catalogued procedures;

SYS1. PARMLIB--this file includes system parameters used by the nucleus initiation program and by the main coordinating program;

SYS1. MACLIB--this file contains system macrodefinitions for the ASSEMBLER's macroinstructions;

SYS1. SORTLIB--this file contains load modules from which the system creates the SORT-MERGE program;

SYS1. MANX;

SYS1. MANY--these files contain information established by the procedures determining the statistics for system utilization;

SYS1. NUCLEUS--this file contains the resident part (nucleus) of the control program;

SYS1. SYSLOGX;

SYS1. SYSVLOGY--these files contain a chronicle of system operations containing, among other things:

--information submitted by the operator;
--task time, task step time and DD and EXEC sentence information;
--operator commands.

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GROWING USE OF NONCONVENTIONAL TECHNOLOGY SEEN IN INDUSTRY

Bucharest CONSTRUCTIA DE MASINI in Romanian No 4-5, Apr-May 81 pp 170-172

/Article by Dr Eng Ioan Roman of the Bucharest Technological Research Institute for Machine Building: "A New Stage in the Expansion of Nonconventional Technologies in the Industry of the Socialist Republic of Romania"/

/Text/ Our country's industrial development has necessitated alignment with th newest gains in technology on a world level, in order to be able to provide the proper quality and efficiency to the technological processes.

The implementation and expansion of nonconventional procedures of machining represent a significant example in this regard. Although their efficiency no longer has to be proved, the introduction into industry has been relatively slow, mainly due to the lack of our own manufacturing of equipment for these procedures and of a properly organized potential of conception.

For this reason, under the coordination of the ICCM /Central Institute for Metallurgical Research/, a coordinated program for a 5-year period, which proposed actions of a nature to reduce the gap that our industry had with regard to the industrialized countries, was drawn up in 1975.

Among the main objectives that the program also proposed, we mention the following:

The organization and specialization of research and design staffs for preparing for our own manufacturing of equipment;

The transition to the assimilation of families of equipment that would favor the implementation of nonconventional technologies in our industry;

The providing of centralized manufacturing of them by specializing an enterprise;

The concentration of all the forces that we have in departmental and higher-education institutes on carrying out the proposed program.

At present, we are in a position to draw up a balance sheet of the efficiency of the program carried out for a relatively short period and to draw the proper conclusions for the new, 1981-1985 program.

Thus, within the framework of the program, we will mention the main achievements, which are:

The achievement of research work that has laid the foundations for the designing of EDM [electrodischarge machining], ECM [electrochemical machining], USM [ultrasonic machining] and laser equipment;

The designing of families of EDM machines by the ICTCM [Technological Research Institute for Machine Building], the ICPE [Research and Design Institute for the Electrotechnical Industry], the IPA [Automation Design Institute] and the University of Brasov (the ELER-SD machine, the small ELER-11 machine, the medium ELER-01 machine, the big ELER-21 machine and the ELEROFIL-10 machine with peak performances, which are now being manufactured or in the process of assimilation for series production);

The designing and achievement of lasers, as well as machines of US 150 and 500 W, for the finishing of drawplates or other similar parts, by the ICTCM, the IFA [Institute of Atomic Physics] and the Iasi IF [Institute of Physics];

The designing and achievement of electrochemical deburring machines, as well as the ECM machine meant for the machining of molds for forges;

The providing of centralized manufacturing of EDM machines at Timisoara "Electrotimis" and Bucharest "Electrotehnica" for EDM generators and ECM sources;

The formation of specialized staffs capable of tackling at present any problem in the field of nonconventional machining.

After a number of preparatory research projects, which consisted of studying phenomena that appear in the processes for machining by means of nonconventional procedures, the designing of EDM, ECM, laser and USM machines was undertaken by specialized staffs, in accordance with a process corresponding to the assimilation of new products. Among them, greater attention was devoted to EDM technologies and equipment, as being the most necessary ones in the first stage of carrying out the program.

Thus, a family of EDM machines has been conceived, starting with the smallest one, the ELER-ED displaceable machine, designed and achieved by the University of Brasov, and ending with the ELEROFIL-10 machine, an electrodischarge machine with a wire with CNC [computerized numerical control].

At present, in this field, we can assert that the present family of general-purpose electrodischarge machines in five prototype dimensions, supplemented with the big machine with a wire and numerical control that is to be achieved, satisfies our industry's needs to a degree of over 95 percent.

In the field of electrochemistry, the technologies, that is, the equipment for deburring, greatly needed by the industry for hydropneumatic apparatus and the industry for automotive components and aviation, have had an exceptional spread.

Regarding three-dimensional electrochemical machining, it is less utilized by our industry, the phenomena that appear have been less thoroughly studied by researchers and, for this reason, it is insufficiently mastered, especially with regard to the precision of machining. The equipment made thus far, very productive as a matter of fact, provides precisions within the limits of 0.2-0.6 mm depending on the type of the machined part, which presupposes, in some cases, a final machining to a higher precision by means of another procedure, such as, for example, electrodischarge.

A number of laser and ultrasonic installations, utilized especially in the machining of diamond and metallic-carbide drawplates and in the making of openings of small dimensions for nozzles for various purposes, have also been researched and designed.

For all these things, standards, prospectuses and guiding materials have been drawn up and conferences and demonstrations for the specialists in plants and institutes have been organized, in order to know these procedures as well as possible and implement them in industry. The above-mentioned actions have had great effectiveness in spreading the nonconventional procedures of machining in the machine-building plants.

The production bases of the ICTCM and the ICPE, which achieved all the prototypes of the above-mentioned installations, as well as the manufacturing series for some equipment (such as the deburring machines), for which there is not yet a producer in industry, have had a big role in finalizing the work.

This method of approaching and finalizing the work has had as an effect a shortening of the assimilation cycles and a putting of the finishing touches on the construction and technological solutions, under conditions of high quality.

Under similar conditions, the ELER-SD machine has been achieved by the University of Brasov, with the utilization of the work being accomplished by means of series production of the machine by the shops of the same institution.

This represents an example of the way in which we want the work contained in the current program to be finalized by all the collaborators.

As a consequence of this action, in comparison with about 70 imported EDM machines (those that existed in 1977) in machine building, this figure now represents a single year's output of the "Electrotimis" Enterprise in Timisoara, which, as we mentioned, is mass-producing these machines.

It is also worth mentioning the fact that all this equipment is of our own devising, achieved with a supplementary importation of at most 5 percent of its value.

All these things have made a big contribution, direct or indirect, to the rise of the technical level of the technologies in our industry and, implicitly, to the growth of labor productivity, the reduction of the cost price, the improvement in quality and so on.

As minuses in the manner of carrying out the program, we can mention:

The still-long assimilation cycles for some of the equipment;

The elaboration of work without a strict orientation to the objectives pursued by means of the program;

The relatively low participation of the specialists in higher education in carrying out the program, especially in the phase of utilization (with the exception of the University of Brasov);

The insufficient utilization of some of the work done.

Nevertheless, it can be said that the program has succeeded, to a great extent, in achieving what it proposed and that the preparation of a similar one for the 1981-1985 period is essential.

Thus, as a result of fulfilling the main provisions of the program, the situation of of the nonconventional technologies in industry has changed considerably, a real basis for strong expansion of these technologies during the current 5-year period has been created.

Synthesising, the situation is at present the following:

The percentage of the main nonconventional procedures of machining in the country is the following: about 70 percent for electrodischarge, 20 percent for electrochemical machining and deburring, 5 percent for laser, USM and electron beam, and 5 percent for other procedures;

While the equipment for nonconventional machining represented 0.12 percent of the total stock of machines for machining in 1975, it is judged that this percentage was 0.3 percent in 1980. At the same time, this percentage is 2-6 percent in the strongly industrialised countries, which, as one sees, still represents a big gap for our country;

In order to raise the percentage to about 2 percent, we would have to produce about 500 machines per year during the current 5-year period, which is practically impossible, but the attainment of the percentage of 0.8-1 percent at the end of the 1981-1985 5-year period is perfectly possible, both by increasing the research and design capacity and (especially) by increasing the volume of production of this equipment.

As one sees, the situation of the implementation of the technologies for machining by means of nonconventional procedures has improved considerably, in a relatively short time, but it cannot satisfy us, considering also the trends on a world level in this field.

In the strongly industrialized countries, there is intense concern for further increasing the percentage of the nonconventional procedures, as well as along the line of improving the equipment and technologies, as follows:

In the field of electrodischarge machining (EDM):

The achievement of special ED machines, for introducing them into the lines of series production;

The achievement of ED machining centers;

ED machining by means of generation;

Complex kinematic machining by increasing the number of movements of the tool and the part;

New procedures for machining by means of electrodischarge sparks (grinding, surface hardening and so on);

In the field of electrochemical machining (ECM):

The increasing of the precision of EC machining;

EC deburring of big burrs;

New electrochemical procedures (grinding, engraving, printing and so on);

In the field of laser machining (LBM):

The increasing of the energy of the radiation and the utilization of continuous lasers (utilization of YAG-Nd /yttrium aluminum garnet-neodymium/ and so on);

The automation of auxiliary operations;

The improvement of laser optics;

The expansion of the utilization of laser installations (engraving, microcircuit printing, resistant adjustments, controlled fissuring of natural crystals and so on);

In the field of ultrasonic machining (USM):

The increasing of the useful power;

The achievement of special tools resistant to wear;

The expansion of the fields of application (complex machining).

The program that has been drawn up for the 1981-1985 period takes these trends into account, as well as the current possibilities and needs of our industry, and includes mainly the following:

The diversification of the general-purpose EDM machines with a massive electrode and with a wire;

The improvement of the EDM machines in series production, in order to maintain their competitiveness both functionally and (ca dispozitivare);

The achievement of specialized EDM machines (for big molds for tires, auto bodies and so on);

The improvement of EDM technologies;

The assimilation of special materials for electrodes in the country and the improvement of the technologies for achieving them;

The improvement of ECM equipment and technologies;

The improvement of laser and US equipment and technologies;

The starting of the work of assimilating the machines for electron-beam machining.

In view of the current conditions regarding the material base existing in the departmental institutes and those of higher education, the research and design force that we have, and the possibilities created by the centralized manufacturing of the equipment for machining by means of nonconventional procedures, it can be asserted that the program has a real basis and that it will be fully carried out.

It is financed mainly by the ICCM and keeps track of the achievement of both its own work and that financed and done by other institutions, in order to avoid duplication.

The experience gained thus far allows us to approach the work on a higher level and with a greater degree of certainty regarding finalization and utilization.

Regarding the equipment mentioned in the program, in addition to the proposed objectives, we intend to expand the typification both of the machines and of their component elements.

Through the way in which the tasks have been established, assigned and approached, the responsibility regarding the participation of each collaborator in resolving and utilizing the work has been strengthened.

Thus, the new program is of a nature to provide a substantial increase in the percentage of the procedures of nonconventional machining in our industry and, ultimately, an alignment with the trends that appear on a world level.

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MICROBIOLOGY RESEARCH AIDING EXTRACTIVE, ENERGY INDUSTRIES

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[Article by Dr Ioan Lazar, head of the Microbiology Laboratory, Bucharest Institute of Biological Sciences]

[Text] In the context of the current biological revolution, the expansion and penetration of biotechnology into the most diverse economic fields, the problems tied to the nutrition and energy of the future acquire new values and dimensions. At this point, a number of economically developed countries have a rich experience and wide-ranging programs in terms of biology and protein resources and also in terms of biology and new energy resources. In Romania, the party and state policy, the tasks that follow from the programs of directives endorsed by the 12th Congress of the RCP, the instructions directly received from party secretary general Nicolae Ceausescu at the time of his visits to the Institute of Biological Sciences in 1974 and 1979, and the guidelines that result from the October 1980 Working Conference With the Active in the Field of Geology significantly promote the development of a national program of biotechnology, a program which now is in an advanced stage of formulation and which focuses on the major issues of our economy.

The activity conducted so far at the Microbiology Laboratory of the Bucharest Institute of Biological Sciences already has produced a number of results that are appreciated by the various customer units. We shall dwell on a few of them.

Laboratory research, followed in the last 4 years by field experiments, demonstrated that the use of bacteria in processes for release of crude from deposits helps to increase the oil yield in wells.

Microbiological procedures for stimulating the release of oil from deposits is based on injecting into the deposit bacteria populations together with a nutritional support whose degradation produces large amounts of gas, organic acids and surfactants, products that aid the release of the remanent crude in the rock. This procedure, which was mastered and upgraded for the first time in this country by our laboratory -- in close cooperation with experts of the Cimpina Research and Design Institute for Petroleum and Gas, that completed more than 50 procedures on the site -- helped to demonstrate that in deposits which meet the requirements involved in the microbiological method rises between 15 and 150% in the crude yield in wells is obtained. More specifically, we point out that in wells where prior to the use of the

microbiological method output was, for instance, 0.9-1 ton of crude/day, after the use of bacteria injections the crude yield went up to 1.4-1.5 tons/day. The duration of the positive effects of the procedure was from 1 to 4 years. (However, the high percentages were obtained at wells with outputs up to 0.5 tons of crude/day).

Because the microbiological procedure is very inexpensive, it can be applied by using the equipment in existence at oilfields, and so forth, in 1981-1982 it will be tested in deposits that include a larger number of wells, for the purpose of determining all resources for utilizing the method on an industrial scale.

In recent years these studies have been conducted with growing intensity in many oil-producing countries and Romanian experience has attracted the attention of experts. Moreover, some prestigious scientific events included our surveys in their programs.

Concurrently with research on promoting oil release by injecting a special bacterial inoculum adapted to oil deposits, other studies have commenced in the last 2 years, also in close cooperation with the Cimpina institute. These studies focus on obtaining bacterial polysaccharides (biopolymers), which will be used to dislocate the crude from collecting rocks. So far, bacteria strains with a high efficiency in terms of biosynthesis of biopolymers have been selected and the biopolymer which we have obtained in laboratory phase is assessed by experts of the Cimpina institute as qualitatively similar and hence competitive to American products.

Another direction also tied to the extractive industry in which our laboratory has accumulated useful results and experience involves the use of bateria to extract metals from poor ore or waste dumps and to remove sulfur from coal. In a number of countries including some neighbors, as for instance Bulgaria, large amounts of copper (up to 20% and even more from the annual output) are extracted by using the microbiological procedure. Our research conducted in cooperation with experts from specialized institutes in Baia Mare and Deva has so far focused on bacterial solubilization of copper and uranium. Moreover, under the 1981-1985 Five-Year Plan, research will be expanded to include also other useful elements such as zinc, lead, nickel, manganese, cobalt, and so forth. Studies in laboratory phase have permitted to obtain active bacteria populations for copper extraction, populations that have been taken over by experts in the network of benefitting units for the purpose of beginning to use them in practice. A significant input has also been provided into best possibly estimating the physiological and ecological factors that impact the process of solubilization of copper and uranium in poor ores.

Concerning removal of sulfur from coal with a high level of sulfur (more than 2-3%) by using bacteria, the studies conducted by our laboratory, in conjunction with the Faculty of Technological Chemistry of the Bucharest Polytechnic Institute, are among the few of this kind in the world. They demonstrated that a large amount of pyritic sulfur contained in coal can be removed or transformed with the aid of bacteria. For the time being, the method can only be used for coal sludge that results from flotations. The use of bacteria to remove sulfur from coal, however, has outstanding prospects — in terms of potential uses — in desulfurization of liquid or gaseous fuels that result from liquefaction or gasification of lignites.

The third investigative direction of the laboratory which we would like to discuss very briefly involves obtaining energy from unconventional sources. So far the

research team involved in this project has obtained interesting results in the area of isolating bacterial populations for the purpose of developing an inoculum that generates the increase in the rate of conversion into biogas of the mud in hog-raising complexes; detecting new, still unused, substrata that would yield biogas and devising new approaches that would permit the increase in the production of biogas in the case of anaerobic fermentation of muds in animal-raising complexes or in the urban waste water treatment stations. The bacterial populations selected in recent years, the thought of creating an inoculum on a solid support, and the addition of special ingredients to zootechnological or urban muds, now fermented anaerobically for the production of biogas open up very promising prospects for raising the rate of conversion in fermentation combustible gases. Laboratory studies in recent years have determined that the special ingredients, just as the inoculum on solid support, which produce important increases in the production of biogas, are based on the use of a residual mud from a specific kind of factories in the area of industry, a mud which so far has nowhere in the world been capitalized on to the benefit of the factories that produce it. Moreover, during the last year, utilization of these ideas has also involved for our laboratory two proposals for invention.

Furthermore, in a rather advanced laboratory stage are surveys that focus on obtaining methane by reducing carbon dioxide by means of methanogenic bacteria. Resolving such a problem is of outstanding importance specifically if we consider the large resources of carbon dioxide in existence. However, for the time being these surveys have a basic character not only in this country but on a world scale also. Consequently, the industrial uses of this new source of energy belong to the not too near future.

Beginning with the 1981-1985 Five-Year Plan, the Microbiology Laboratory has been preparing to tackle also other directions for the purpose of obtaining energy from unconventional sources, notably obtaining energy-carrier alcohols (for example ethyl alcohol) from biomass and pulp waste and obtaining hydrogen with the aid of microorganisms.

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DATA ON ROMANIAN APPARATUS USED ON JOINT SPACE FLIGHT

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[Unattributed article]

[Text] A good portion of the research and experiments done by the first Romanian cosmonaut Dumitru Prunariu and the pilot, Soviet cosmonaut Leonid Popov, on board the Soyuz-40, Salyut-6 and Soyuz -T4 was done with apparatuses conceived and created by specialists from Romania.

This research can be divided into three big categories: physical, technological and medical. The one named Astro held an important spot in the physical experiments. Its purpose was to seek and study incompletely ionized atoms, to investigate the processes of fragmentation and interaction of the heavy cosmic ions of high energy, to obtain their spectra charge and energy and to identify new forms of existence of nuclear matter (incompletely ionized atoms from cosmic radiation or nuclei with a large number of neutrons). These data are very necessary to the studies of nuclear physics, and astrophysics of high energies and the physics of heavy ions. In order to do the experiments, the specialists from the Astronomy and Space Sciences Center and from the Institute of Nuclear Physics and Engineering in Bucharest built two apparatuses. The first, Astro-1, assembled on the exterior of Salyut-6 four years ago when it was launched, is recording cosmic radiation completely, eluding the effect of the cabin walls. The second apparatus, Astro-2, brought there in Prunariu's "luggage," is noted by its highly miniature state, reduced energy consumption, high reliability. Placed inside the station and controlled by an electronic and mechanical system it localizes the latitude at which each particle is recorded. These apparatuses--which are an innovation at the world level--are supplied with plastic detectors which, following irradiation in cosmic space, were brought back to earth by the Romanian cosmonaut to be studied in Bucharest. The other complex for physical research, Biodose, was composed of two experiments: "complete" and "minidose," with the particular apparatus also created by Romanian specialists. The "complete" experiment proposed to measure the flows and spectras of the heavy cosmic ions in various points of the orbital laboratory. At the end of the mission, Prunariu brought back to earth the blocs of detectors (in order to be studied in Romania), with the remainder of the apparatus continuing to record the particular data. During the second experiment, the Romanian cosmonaut, with the aid of the Minidose-178 apparatus, measured the flow of protons from the earth's radiation belts. The purpose of this experiment lies in better estimating the radiation risks to the human teams on the space missions. Another group of research, Nanobalance, is at the borderline between physical and

technological. Done with apparatuses conceived and built at the Cluj-Napoca Institute for Isotopic and Molecular Technology, the experiments mentioned led to obtaining some interesting information on the establishment of thin protective strata of silicon dioxide under the action of the cosmic atmosphere (radiation, vacuum and so forth) in order to determine how long such a protective stratum can last. The Romanian apparatus determines the mass of a thin stratum with a precision of up to one-tenth of a billionth part of a gram. Capillary-1 was an experiment with a purely technological nature. Both the apparatus as well as method utilized are firsts in the history of space research. This technology sought to determine the possibilities of obtaining monocrystals preestablished by using the capillarity effect. The method can produce results only in outer space, since gravity on earth creates many difficulties in applying it. In the near future, the experiments from the Capillary series (2 and 3) will have as their purpose obtaining utilizable silicon monocrystals even on board the spaceships (solar batteries). Thought out by Romanian specialists at the D. Danielopolu Institute for Normal and Pathological Physiology and the Center for Space Medicine and the St. S. Nicolau Virusology Institute and other institutes and done with apparatuses conceived and built nearly entirely in Romania, the medical research also included many series of experiments: Miocardia (seeking cardiac phases under the conditions of a space flight), Ballisto (analyzing the force of cardiac contraction under circumstances impossible to achieve on earth), Homeostasis (investigation of hormonal and enzyme changes), Immunity (the study of the organism's defense capability toward viruses), Information (following various mental processes and qualities of the cosmonauts), Reo (knowledge of the change in cerebral blood circulation as well as central and peripheral in various stages of the space mission), Collar (oriented toward the study of the effect of imponderables on the organism) and Pneumatic (obtaining data on the reaction of the cosmonaut's organism in the period of adaptation to the imponderables). It should be noted that the experience gained by the Romanian specialists in creating some of these medical apparatuses will be utilized in building high-performance installations for use on earth.

The complete success of this space mission--due to which Romania has entered among the countries participating directly in space exploration--was a prestigious contribution to the progress of science and technology placed at the service of man, civilization and peace.

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